

TWO NEW SPECIES OF THE FRESHWATER CRAYFISH *EUASTACUS* CLARK
(DECAPODA: PARASTACIDAE) FROM ISOLATED HIGH COUNTRY OF QUEENSLAND

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Two new species of *Euastacus*, *E. bindal* and *E. monteithorum* are described from Queensland. Both are morphologically similar to *E. eungella* but differ in spination of the carapace and chelae and in the shape of the sternal keel. The species inhabit streams in isolated pockets of elevated rainforest on Mt Elliot and Kroombit Tops. A key to Queensland *Euastacus* species is modified to incorporate these species. Biogeographic affinities of *Euastacus* and the frog genus *Taudactylus* are discussed.

□ Crustacea, Parastacidae, *Euastacus*, Queensland.

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Freshwater crayfish of the genus *Euastacus* Clark occurring in Queensland have been discussed in several taxonomic studies including Watson (1935, 1936), Clark (1936, 1941), Riek (1951, 1956, 1969), Monroe (1977) and Morgan (1988). Subsequent to the extensive collection undertaken by Morgan (1988), several specimens of *Euastacus* were collected from two previously unsampled highland localities in Queensland. Examination of the specimens revealed them to be representatives of two undescribed species.

Methods, terminology and abbreviations employed here are those described by Morgan (1986, 1988). Collection localities are indicated in Figure 1.

***Euastacus bindal* sp. nov.**
(Fig. 2)

MATERIAL EXAMINED

HOLOTYPE: ♀, OCL 24.9 mm, upper North Creek, Mt Elliot, (19°30'S, 146°58'E), NEQ, 1000 m, rainforest, 2-5 December 1986, coll. Monteith, Thompson and Hamlet, QM W15582.

PARATYPE: ♂, OCL 17.7 mm, type locality, QM W15582.

DIAGNOSIS

Similar to *E. eungella* Morgan, but differing in having numerous blunt spines lateral to dactylar articulation of chelipeds on both dorsal and ventral surfaces, spines distributed some distance distally along fixed finger; dorsal carpal spines absent; 4th mesial carpal spine well developed and subequal to 3rd spine; rostral spines larger; sternal keel between Pr3 and Pr4 blunt and not produced in a sharp carina.

DESCRIPTION

Rostrum: Short, reaching base of 3rd antennal segment. Rostral margins parallel or slightly divergent; carinal bases short and divergent. 2 medium-sized, moderately acute marginal spines per side, distributed slightly proximal to midlength of carinae. Acumen spine slightly larger than marginal spines. OCL/CL 0.86-0.87. RW/OCL 0.14-0.16.

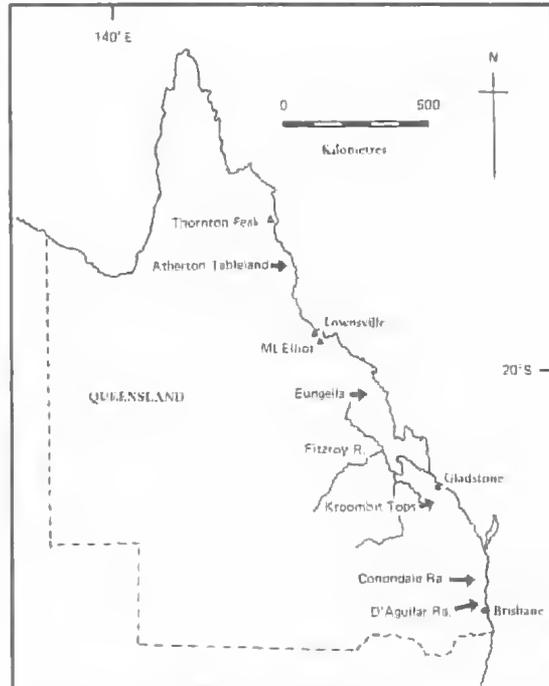


FIG. 1. Type localities of *E. bindal* (Mt Elliot) and *E. monteithorum* (Kroombit Tops), with other localities mentioned in text.

Cephalon: Weakly spinose, 1st postorbital spine medium-sized or small; 2nd postorbital spine absent. Suborbital spine medium-sized. Antennal squame with lateral margin distinctly concave, lacking spines, squame widest approximately at midlength. Epistome (interantennal spine) moderately elongate with weakly scalloped margins. Antennal basipodite spine absent; coxopodite spine weakly developed. ScL/OCL 0.15-0.16.

Thorax: Dorsal spines absent. Thoracic tubercles small and densely distributed on holotype, very small and sparser on paratype. Cervical spines weakly developed. ArL/OCL 0.38-0.39, ArW/OCL 0.17-0.18, CaW/OCL 0.51-0.52, CaD/OCL 0.45-0.48.

Abdomen: Abdominal spines absent except for 4-5 small blunt Li spines on somite 2 of holotype, absent on paratype. Dorsal boss absent. AbdW/OCL 0.48-0.49, OCL/L 0.40-0.41.

Tailfan: Dorsal telsonic spines absent, surface roughened. Distolateral spines medium-sized. TeL/OCL 0.33-0.34.

Chelipeds: Chelae moderately stout (regenerate right cheliped of holotype elongate).

Dactyl: 6 spines dorsal to cutting edge, distributed along full length of gape, spines medium-sized to large (largest proximally) and moderately acute. 1 additional distodorsal spine on dactyl of non-regenerate chela of holotype. Mesial basal spines absent; 2 mesial apical spines. Dactylar groove deep. DactL/PropL 0.49-0.52.

Propodus: 2 lateral spine rows, ventral row reaching to or proximal to midlength of propodus; spines medium-sized and broadly triangular with small corneous tips. 6 mesial spines on palm (including rather blunt spine at distal angle). Holotype with 4 and paratype with 2-3 dorsal apical spines on non-regenerate chelae, (2 spines on regenerate chela of holotype), spines forming longitudinal row along fixed finger and almost reaching spines lateral to dactylar articulation. 4-6 medium-sized to large (largest proximally) spines dorsal to cutting edge, spines distributed in row along entire gape. Dorsal and ventral surfaces of palm and proximal part of fixed finger with numerous blunt spines and tubercles lateral to dactylar articulation, spines distributed some distance along fixed finger. No spines proximal to dactylar articulation. PropL/OCL 0.90-0.97, PropW/PropL 0.44-0.47, PropD/PropL 0.31-0.32.

Carpus: Deep dorsolongitudinal groove. 4 mesial spines, distalmost (1st) largest and strongly offset ventrally to others; 4th spine subequal to or only slightly smaller than 3rd spine (much smaller

than 3rd on regenerate chela of holotype). Lateral spines weakly developed or absent. Dorsal spines absent. Ventral spine medium-sized and much larger than 3-5 small blunt ventromesial spines.

Merus: 7-8 small dorsal spines, distal 2 similarly sized to others. Distolateral spine minute or absent.

Keel: Pr1 with posterior margin sloped; processes close and parallel. Pr2 approximately parallel and apart. Pr3 with posterior edges rather rounded. Pr4 with anterior edges angular, posterior edges sharp and convex. Keel lacking spines, only bluntly carinate between Pr3 and Pr4.

Setation: Moderate on holotype, light on paratype; setae short.

Punctuation: Rather dense on cephalon and thorax.

Gastric mill: TAP count 3.5, TAA count 1.0, spread 2.5. Urocardiac ridges 5; urocardiac ossicle shallow.

Coloration: No live colour notes available.

Sexes: Male paratype with cuticle partition. Female holotype with deeply incised gonopores very lightly fringed with setae, implying imminent onset of maturity.

DISTRIBUTION

The species is known only from Mt Elliot, NEQ. (Fig. 1).

HABITAT

The type locality is near the peak of Mt Elliot, at an elevation of about 1000 m. Rainforest flanks the headwaters and tributaries of North Creek.

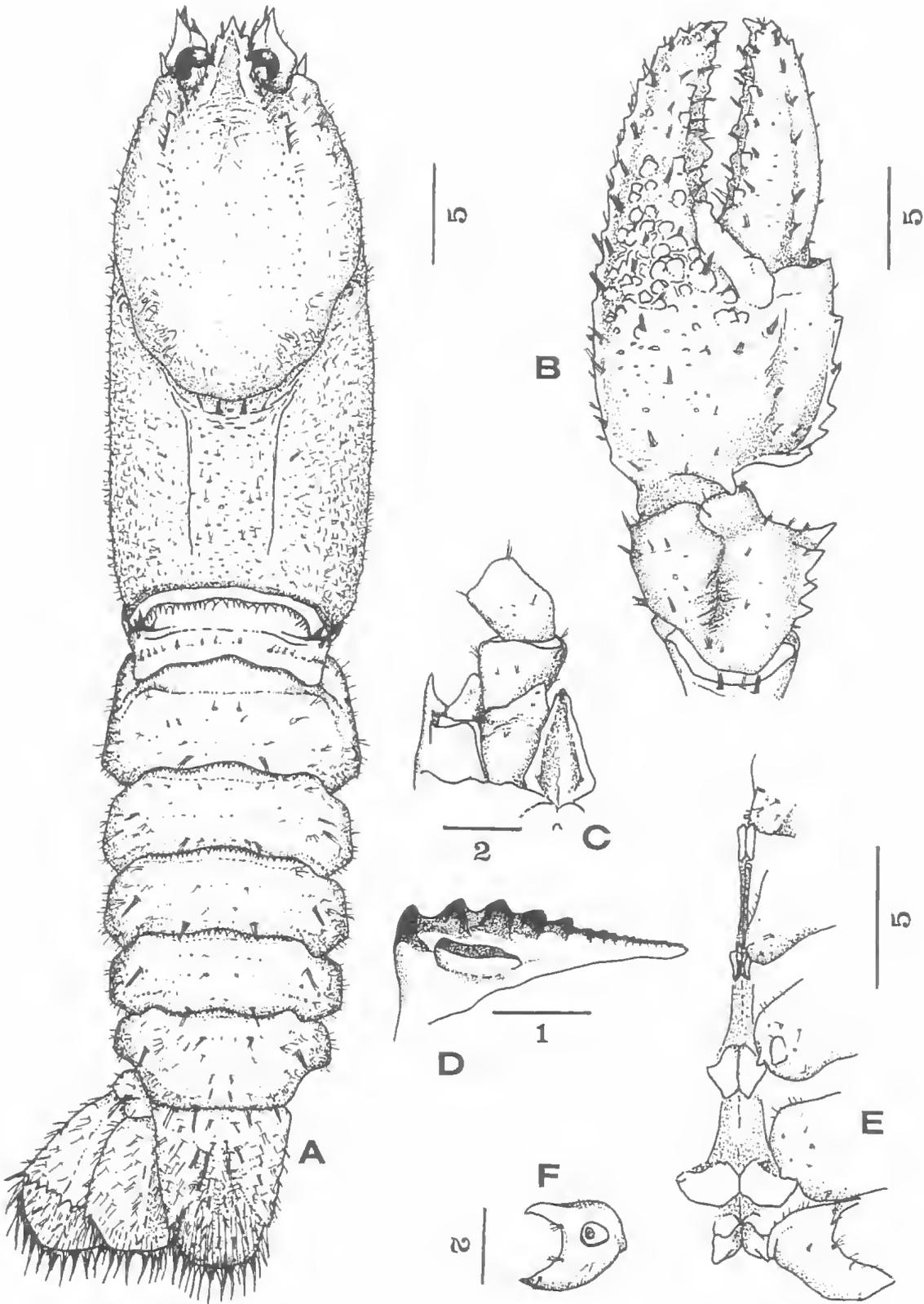
ETYMOLOGY

The species is named after the Bindal aboriginal language of the Mt Elliot area (Oates and Oates, 1970).

REMARKS

The discovery of populations of *Euastacus* on Mt Elliot is not surprising. On a previous collecting trip in 1981, attempts to find specimens there were unsuccessful although the habitat on and near the peak appeared suitable for the crayfish (pers. obs.) with fast flowing cool streams and fringing rainforest.

FIG. 2. *Euastacus bindal*. A-E, holotype ♀, F, paratype ♂. A, cephalothorax, abdomen and tailfan, dorsal view; B, dactyl, propodus and carpus of left cheliped, dorsal view; C, epistome and basal segments of antenna, ventral view; D, zygocardiac ossicle of gastric mill, lateral view; E, sternal keel; F, coxa of fifth pereopod of ♂. Scales in mm.



E. bindal closely resembles *E. eungella* of the Clarke Range, 240 km to the southeast. The species differ most distinctly in ornamentation of the chelipeds.

***Euastacus montelthorum* sp. nov**
(Fig. 3)

MATERIAL EXAMINED

HOLOTYPE: Male, OCL 37.9 mm, 'Beauty Spot 98' (Queensland Department of Forestry), headwaters of Kroombit Creek, Kroombit Tops, (24°22'S, 151°00'E), central Q., 860 m, rainforest, 29 September 1985, coll. G.B. and S.R. Monteith, QM W15583.

DIAGNOSIS

Similar to *E. eungella*, but differing in lacking first postorbital ridge spines; lacking dorsal carpal spines on chelae; keel Pr1 apart and anteriorly convergent and keel between Pr3 and Pr4 very pronounced anteriorly; setation much heavier on thorax and abdomen.

DESCRIPTION

Rostrum: Shorter than base of 3rd antennal segment. Rostral margins slightly divergent; carinal bases short and divergent. 2 medium-sized, moderately acute spines per side, apical or distributed to midlength of carinae. Acumen spine slightly larger than marginal spines. OCL/CL 0.88. RW/OCL 0.13.

Cephalon: Weakly spinose. Postorbital spines absent. Suborbital spine medium-large. Antennal squame with lateral margin straight, lacking spines, squame widest slightly distal to midlength. Epistome moderately elongate with weakly scalloped margins. Antennal basipodite spine absent; coxopodite spine medium-sized. ScL/OCL 0.13.

Thorax: Dorsal spines absent. Thoracic tubercles small and densely distributed. 4 small rounded cervical spines. ArL/OCL 0.40. ArW/OCL 0.18. CaW/OCL 0.54. CaD/OCL 0.45.

Abdomen: 2-4 small, sharp or moderately acute Li spines on somite 2; other somites unarmed except for minute setal bumps in Lii position. Dorsal boss absent. AbdW/OCL 0.46. OCL/L 0.42.

Tailfan: Dorsal telsonic spines absent, surface roughened. Distolateral spines small to medium-sized. TeL/OCL 0.31.

Chelipeds: Chelae elongate (left larger than right but both probably regenerate; proportions cited for left chela).

Dactyl: 5 spines dorsal to cutting edge of larger

left chela, 1 on small right chela, distributed proximal to midlength of gape; spines medium-sized, largest distally, and moderately acute. Mesial basal spines absent on left chela, 1 ventromesial basal spine on small right chela; 2 mesial apical spines. Dactylar groove inconspicuous. DactL/PropL 0.57.

Propodus: 2 lateral spine rows, ventral row reaching slightly proximal to midlength of propodus; spines medium-sized and sharp. 5 mesial spines on palm. Larger chela with 3 dorsal apical spines, small regenerate chela lacking spines. 4 medium-sized, moderately acute spines dorsal to cutting edge on larger chela, distributed proximal to midlength of gape; 1 apical spine only on small chela. Dorsal and ventral surfaces of palm almost smooth lateral to dactylar articulation except for 1 small dorsal and ventral spine and some slight rugosities on large chela, small chela lacking spines. No spines proximal to dactylar articulation. PropL/OCL 0.93. PropW/PropL 0.40. PropD/PropL 0.25.

Carpus: Deep dorsolongitudinal groove. 3 mesial spines, and one proximal tubercle on larger cheliped; distalmost (1st) spine much the largest and only slightly offset ventrally to others. 2 minute lateral spines. Dorsal spines absent. Ventral spine medium-sized and larger than small blunt ventromesial spines.

Merus: About 7 dorsal spines, medium-sized to small. Distolateral spine absent.

Keel: Pr1 with posterior margin semi-abrupt; processes apart and convergent anteriorly. Pr2 almost parallel and apart. Pr3 with sharp posterior edges. Pr4 with moderately angular anterior edges and convex, rather sharp posterior edges. Keel lacking spines but slightly produced posterior to Pr2 and strongly produced posterior to Pr3.

Setation: Moderately heavy, setae short.

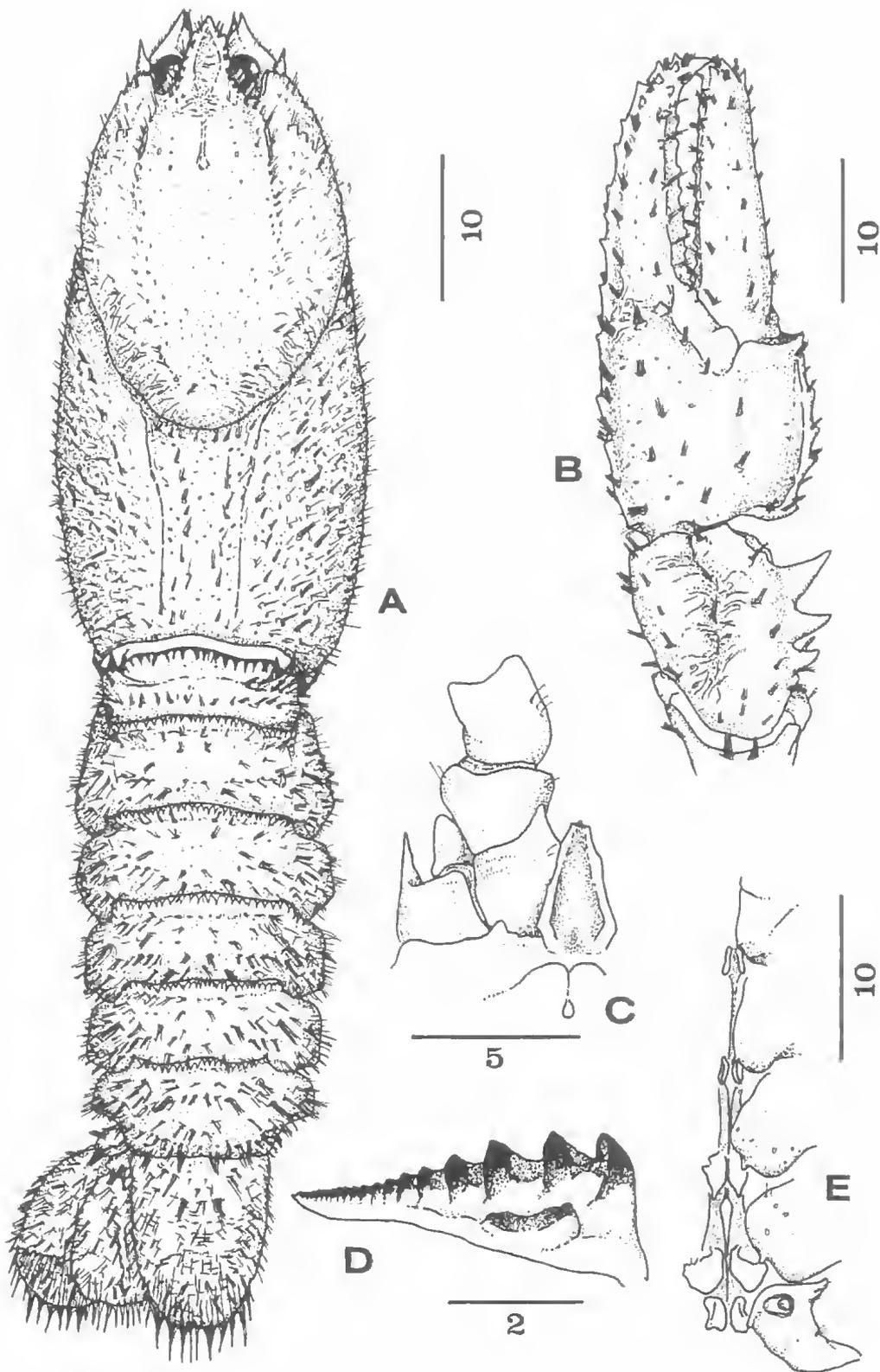
Punctuation: Moderately dense on cephalon, dense on thorax.

Gastric mill: TAP count 3.0, TAA count 1.0, spread 2.0. Urocardiac ridges 6; urocardiac ossicle shallow.

Coloration: No live colour notes available.

Sexes: Male with broad cuticle partition.

FIG. 3. *Euastacus monteithorum*. Holotype ♂. A, cephalothorax, abdomen and tailfan, dorsal view; B, dactyl, propodus and carpus of left cheliped, dorsal view; C, epistome and basal segments of antenna, ventral view; D, zygocardiac ossicle of gastric mill, lateral view; E, sternal keel. Scales in mm.



DISTRIBUTION

The species is known only from Kroombit Tops, CQ (Fig. 1).

HABITAT

The type locality, designated 'Beauty Spot 98' by the Queensland Forestry Department, is on the headwaters of Kroombit Creek and fringed with rainforest (Monteith, 1986). Altitude is approximately 860 m. General data on the habitats of Kroombit Tops were recorded by Monteith (1986) and McDonald and Sharpe (1986).

ETYMOLOGY

The species is named after its collectors, Geoff and Sybil Monteith.

REMARKS

E. monteithorum resembles *E. eungella* and *E. bindal* but differs in its lack of a 1st postorbital spine and in having the keel Pr1 apart rather than adjacent. It also differs from *E. bindal* in having the surfaces of the palms of chelipeds lateral to the dactylar articulation almost smooth and from *E. eungella* in lacking dorsal carpal spines.

KEY

Morgan (1988) presented a key to the Queensland species of *Euastacus*. The following modification will permit incorporation of the new species into that key:

- In couplet 6, the entry of '*E. eungella*' is replaced by '12' which is appended to the key.
- 12 (6). 1st postorbital spine absent; dorsal carpal spines absent; keel Pr1 apart and slightly convergent anteriorly
..... *E. monteithorum*
1st postorbital spine present; dorsal carpal spines present or absent; keel Pr1 close and parallel 13
- 13 (12). Numerous blunt spines on dorsal and ventral surfaces of propodus lateral to dactylar articulation, distributed some distance along fixed finger; dorsal carpal spines absent; 4th (proximal) mesial carpal spine subequal to or only slightly smaller than 3rd spine
..... *E. bindal*
1 or 2 small or medium-sized spines on dorsal and ventral surfaces of propodus

lateral to dactylar articulation, sometimes with some minute lateral bumps or rugosities dorsally but smooth ventrally, spines not distributed along fixed finger; dorsal carpal spines present; 4th mesial carpal spine absent or if present much smaller than 3rd spine *E. eungella*

DISCUSSION

The description of these species brings to 14 the total known species of *Euastacus* in Queensland. Both were collected from elevated, relatively remote areas accessed only with some difficulty, with isolated stands of rainforest. The habitats of the localities, although not recorded in great detail, agree with the general appraisal of *Euastacus* habitats recorded by Morgan (1988).

Both *E. bindal* and *E. monteithorum* show closest morphological affinities with *E. eungella*. Mt Elliot is approximately 240 km northwest of the Eungella-Clarke Range habitat of *E. eungella*. The intervening country is mostly of low elevation, with few areas exceeding 800 m, and mountain rainforest is rare. Suitable habitat for *Euastacus* is unlikely to exist today between these localities. Mt Elliot is separated by about 250 km from the Bellenden Ker region to the north, inhabited by *E. balanensis* Morgan. The intervening country has some high altitude areas with mountain rainforest (e.g. Mt Spec, Cardwell Range) but previous collection in these areas did not yield specimens of *Euastacus*. Similarly, Kroombit Tops lies about 425 km southeast of the Clarke Range and is separated by low relief. A further 280 km of relatively low country then separates Kroombit Tops from the Conondale Range area, home of *E. hystri-cosus* Riek and possibly *E. urospinosus* (Riek).

The ecological isolation of their known ranges supports the recognition of the two morphotaxa as biological species. These distributions confirm the relict population theory proposed by Morgan (1988). North of southeastern Queensland, *Euastacus* species are confined to relatively small, elevated areas of rainforest, with the associated cold, fast flowing streams. It is interesting to compare this distribution with that of other montane species.

In particular, a nearly parallel distribution is displayed by the myobatrachid frog genus, *Tau-dactylus*. These frogs are found exclusively associated with streams in elevated (above 300 m) areas of rainforest in eastern Queensland (Liem and Hosmer, 1973; Ingram, 1980; Czechura, 1986).

TABLE 1. Distributions of species of *Taudactylus* and sympatric *Euastacus* in Queensland.

Locality	<i>Taudactylus</i>	<i>Euastacus</i>
Thornton Peak, Mt Lewis, Atherton Tableland	<i>T. rheophilus</i> Liem and Hosmer <i>T. acutirostris</i> (Andersson)	<i>E. robertsi</i> Monroe <i>E. fleckeri</i> (Watson) <i>E. balanensis</i> Morgan
Mt Elliot	—	<i>E. bindal</i> sp. nov.
Clarke Range, Eungella	<i>T. liemi</i> Ingram <i>T. eungellensis</i> Liem and Hosmer	<i>E. eungella</i> Morgan
Kroombit Tops	<i>T. pleione</i> Czechura	<i>E. monteithorum</i> sp. nov.
Blackall, Conondale, D'Aguilar Ranges	<i>T. diurnis</i> Straughan and Lee	<i>E. setosus</i> (Riek) <i>E. hystricosus</i> Riek <i>E. urospinus</i> (Riek)

Their distributions and those of sympatric *Euastacus* species are listed in Table 1. The only locality north of the D'Aguilar Ranges that supports *Euastacus* but from which *Taudactylus* has not been recorded is Mt Elliot. Given the close similarities in both habitats and distributions of the two genera it might be suggested that Mt Elliot may well support a hitherto undescribed population of *Taudactylus*.

Ingram (1980) and Czechura (1986) discussed the probable mechanism of isolation of *Taudactylus* species in Queensland. The expansion and contraction of rainforest will have affected all species restricted to this habitat and the parallel distributions of *Euastacus* with other fauna requiring similar habitat is therefore to be expected.

Most of the habitats of *Euastacus* in Queensland are assignable to the 'large, relatively wet' rainforest refugia category of Webb and Tracey (1981), where mesic communities occur on summits and gullies on the slopes of wet mountains. Mt Elliot can scarcely be regarded as 'large', but the other criteria apply. Webb and Tracey (1981) might consider Kroombit Tops, together with the nearby Many Peaks Range, as a 'topographic-edaphic-climatic' isolate but the rainforest there is still supported by heavier rainfall (average 1800 mm per year) than in adjacent areas (McDonald and Sharpe, 1986).

Kershaw (1981) and Webb and Tracey (1981) discussed the probable patterns of climate and expansion and contraction of rainforests in Queensland during the Quarternary. Topography and soils permitting, rainforests essentially expand with increasing effective moisture and are therefore most extensive during periods of high

warmth and rainfall. *Euastacus* is confined to rainforest in central and north Queensland but its requirement of cool water conditions restricts the genus to montane areas. Therefore caution should be exercised in extrapolating *Euastacus* distributions from that of rainforests. The increased temperatures conducive to expansion of rainforest may in fact result in contraction of the suitable coldwater habitat of *Euastacus* to greater elevations. Hence, *Euastacus* distributions may have been more extensive prior to the end of the last glaciation (10,000-8,000 years B.P.) when temperatures and rainfall began to rise. Species of the more widespread and warm water tolerant parasitic genus *Cherax* inhabit rainforest streams at lower elevations to *Euastacus* (pers. obs.) and it might be predicted that the distribution of this genus will have expanded and contracted inversely to that of *Euastacus*.

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